

## THE CONDITIONING OF TEXTUAL RESPONSES USING "EXTRINSIC" REINFORCERS<sup>1</sup>

ARTHUR W. STAATS, CAROLYN K. STAATS, RICHARD E. SCHUTZ,  
AND MONTROSE WOLF

ARIZONA STATE UNIVERSITY

Six 4-year-old Ss were presented with a textual program consisting of 26 words arranged so the word stimuli were gradually combined into sentences and then short "stories." Three Ss were given the No-Reinforcement condition first, and only social reinforcers were presented. They were switched to the Reinforcement condition as soon as they requested discontinuance of the activity. The other three Ss were given Reinforcement—No Reinforcement—Reinforcement treatments. The No-Reinforcement treatment in this case lasted until S requested discontinuance of the activity. The reinforcers were mixed edibles and trinkets, as well as tokens backed up by small plastic toys on a 1:24 ratio. The unit of response was the number of new texts acquired as a result of each of the 45-min experimental sessions. It was demonstrated that the program, procedure, and reinforcement conditions produced curves which are analogous to those produced in common operant-conditioning procedures. The results indicate that other operant principles may be studied in this significant area of human behavior, with important practical consequences.

In the extension of operant-conditioning principles to teaching devices, little systematic work has been concerned with the nature of the potential reinforcers. Porter, in reviewing the literature on teaching devices, indicates that exploratory and manipulative activities have been suggested as reinforcers but that these weaken through satiation. He comments that alternative reinforcers could be used. Skinner has mentioned social reinforcers, desired activities, and aversive stimulation; and Pressey has indirectly suggested candy. Porter concludes "Most authors of articles concerning immediate reinforcer teaching devices are content, however, to side-step the problem of what reinforcers to use" (1957, p. 135).

More recently, however, Holland has stated that "With humans, simply being correct is

sufficient reinforcement" (1960, p. 278). The statement that being "correct" is positively reinforcing could stand closer scrutiny. The observables which define "correctness" are that the response of the subject produces some record, a stimulus, which matches the stimulus of the "answer" to the item.

Ferster (1960) has shown that pigeons can be conditioned to peck a key that matches (in light value) another key. This type of training would be expected to make the matching stimuli conditioned reinforcers as well as S<sup>D</sup>'s. Therefore, it should be possible to use two stimuli which are variable so that a matching of the two would be the S<sup>D</sup> and a miss-match the S<sup>A</sup>. Later, the organism could be conditioned to vary a manipulandum which would adjust the two stimuli, simply on the basis of the reinforcing value of the match.

On the basis of this type of training, matched stimuli would become a reinforcer for a child. Withholding reinforcement until the child more closely echoed an adult's verbal behavior would constitute an example of such training. Normally, a child would have experienced many trials in which he was reinforced when his response matched a stimulus produced by an "authority" source, and when non-matches were not reinforced.

On the other hand, as with other types of experience, individuals would probably differ

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widely in the amount of this training received. These differences should determine the extent to which "matching" would be reinforcing—an important source of reinforcement in the school situation. This is not the place for a full discussion of this effect; however, the younger the child, the fewer matching conditioning trials he would be expected to have received. In addition, special populations such as mental retardates or lower-class children would be expected to be weakly trained in this manner. Being "correct" would thus be expected to be a weak (if not absent) reinforcer for many people, and especially for very young children in their first learning tasks.

In addition to this source of reinforcement, a "correct" response allows the subject to continue to the next item—thus making a match reinforcing. However, whether or not, or to what extent, such "achievement" will be reinforcing will also be determined by the individual's past history of reinforcement.

Consequently, it seems wise not to depend entirely on the development of teaching techniques which involve only the reinforcement of being "correct" or "moving on," at least for some learning tasks. The present study begins the exploration of the development of textual behavior using additional reinforcers. In doing so, the effect of the reinforcers is established, and a short texting program and experimental procedures are developed with which to conduct further studies. In this stage of the research, the emphasis is less upon mechanizing the program than upon the study of the reinforcers, procedures, the response units, and the program.

## METHOD

### *Subjects*

The six 4-year-old Ss (five boys, one girl) were children accepted for the next year's (1961) fall semester of kindergarten at the Arizona State University Laboratory School. A female graduate assistant transported the Ss from home to the Arizona State University Psychology Department laboratory and back again. Participation in the experiment was entirely voluntary and could be terminated at any time.

### *Reinforcers*

A large variety of reinforcers were used, such as trinkets, edibles, and tokens. The

trinkets were plastic rings and puzzles, toys manufactured for vending machines by the Paul A. Price Co. of New York, and occasional balloons and pennies. Examples of edibles were M&M's, raisins, animal cookies, cereal, and peanuts. The tokens were small, red, plastic discs which were placed in a token board containing 24 appropriate holes. When an S filled the board, he was given a "secret surprise," previously hidden under a black metal box. Secret surprises were predominantly Miniature Brand products such as miniature Band-Aids, Alcoa Aluminum Wrap, and Scotch Tape, as well as plastic cars, plastic soldiers, and miniature tools from the variety store. The trinkets, edibles, and tokens were given in approximately equal numbers. Each S earned about 100 reinforcers per experimental session, and gathered them into a plastic bag as he received them.

### *Experimental Conditions*

The experimental conditions, each involving three Ss, were formed to present these reinforcers. Under one condition (No Reinforcement—Reinforcement), none of the reinforcers was given in the experiment until S requested that the activity be terminated, at which time the delivery of a reinforcer was made contingent upon each correct "reading response." Under the second condition (Reinforcement—No Reinforcement—Reinforcement), Ss were reinforced for each correct "reading response" during the first and second experimental sessions. Reinforcement was then no longer given until S requested that the activity terminate; at this time, the reinforcement procedure was reinstated.

### *Apparatus*

A Universal Feeder housed in an enclosure and controlled by a foot-operated microswitch was used to deliver the reinforcers. The S sat at a low 2.5- by 4-ft table with the Universal Feeder at his left and E at his right.

### *Materials*

*Program Stimuli.* The 27 words of the program which were typed (primary type) on 22 5- by 8-in. cards are listed in the order in which they were introduced: the S's first name, *the monkey, the candy, likes, ice cream, look at, brown, is, the elephant, the lion, has, a tail, gray, circus, the clown, red, and, blue,*

*the drum, the horn, the boy, the girl.* The program started with the presentation of the first 4 cards of these 22. When textual responses had been established to the 5 words of these 4 cards, the words were combined, in various meaningful permutations, into sentences. Thus, when *S* had acquired individual texts to *S*'s name, *the monkey, the candy, and likes*, the following sentences were introduced: *Matthew* (for example) *likes the monkey; the monkey likes Matthew; the monkey likes candy; and Matthew likes candy.*

Thereafter, one new card of the 22 was introduced at a time and used in sentences of this sort as soon as the appropriate textual response had been established. As more word and sentence cards were introduced, *S* continued to be presented with the already learned words and sentences as well, mixed together.

When the first 11 texts as well as the various sentences composed of these words had been acquired, some of the sentences were combined into the following story which was presented on an 8.5- by 11-in. sheet of paper.

the monkey  
look at Matthew.  
look at the monkey.  
the monkey likes candy.  
Matthew likes candy.  
the monkey likes ice cream.  
ice cream is brown.  
the monkey is brown.

In the program, new verbal stimuli continued to be introduced and combined into sentences. The sentences were combined into two stories in addition to the one shown. The second story contained 7 new words, 36 words in all, and 9 lines; the third story contained 9 new words, 83 words in all, and 16 lines.

**Picture Board.** The picture board was an 8- by 12-in. cardboard, which included a small picture of each of the verbal stimuli that could be pictorialized.

**Word Board.** The word board for each *S* consisted of an 8- by 10-in. cardboard with the verbal stimuli *look at, is, the monkey, likes, candy, ice cream, brown*, as well as *S*'s name, arranged in three rows of three words, with a small picture of a common animal substituted for the word in the bottom row of the middle column. The *S*'s name was in the top left position of the word board. Used

with the word board were nine 5- by 8-in. cards, each containing one of the eight words or the picture.

**Discrimination Cards.** The verbal stimuli *likes, has, and, look at, is, and the* that cannot be pictorialized were placed in two rows of three words on each of six 5- by 8-in. cards, with the words occupying different positions on each card.

#### *Procedure*

The children were brought into the experimental room and told, "We are going to look at some pictures and read some words."

**Picture Matching.** The *S* was shown the picture board and a picture of a candy cane on a 5- by 8-in. card identical to the picture in the top left-hand corner of the picture board. Then the *S* was told, "This is a picture of some candy. Can you find the other picture of candy here?" (The picture board was indicated.) If *S* was under the reinforcement condition in this example, as well as those to follow, a reinforcer was delivered contingent upon the appropriate response; if he was under the no-reinforcement condition, a social reinforcer was given, *e.g.*, "all right," "good," "fine." Approximately 8 pictures were presented in this manner unless matching behavior was poor; if so, all 16 were presented.

**Word Matching.** Next, *S* was shown the word board which had *S*'s name in the top-left position and the 5- by 8-in. card containing his name. The *S* was instructed, as an example, "This is the word 'Matthew.' Can you find the other word like it here?" (The word board was indicated.) Approximately six such discriminations were presented unless more were required to shape a stronger matching response.

**Texting Procedure.** The *S* was again presented with the picture board and told that he was now going to learn some words. His name was then presented, and *E* said, for example, "This is the word 'Matthew.' Can you read this word for me?" Next, a card with *the monkey* was shown to *S*, and he was told "These are the words 'the monkey.' Can you find the picture of the monkey? (The picture board was indicated.) Now, can you read these words?" (The card with the verbal stimulus was indicated.) The two cards, *i.e.*, *Matthew* and *the monkey* were alternated in a fairly random sequence until the discriminations

were made. At that point, the stimulus *the candy* was presented, with the picture board; and then the card with this verbal stimulus was alternated with the two preceding verbal stimulus cards.

The fourth card was *likes*, for which there was no pictorial prompt, so the discrimination card procedure was used. The *S* was first shown the stimulus card with just *likes* on it and told "This is the word 'likes.'" Then a discrimination card was presented which included *likes* as one of its six words, and *S* was asked to "point to and read for me the word 'likes.'" The other five discrimination cards were then presented, and each time *S* was to point to *likes* on the card and pronounce the word. Then the card with the single word *likes* was again presented and *E* said "Can you read this word for me? What is this word?" If the correct textual response was not made, the discrimination "loop" was presented again.

After discriminations had been made for the first five words, the relevant sentences were introduced. Other words and sentences were then progressively introduced. The various words and sentences already learned were then continually mixed in with the ones *S* was presently acquiring. When *S* could text the sentences for the first 11 words, he was presented with some of these sentences in story form. The progression in the program was thus from single texts to sentences to stories; but these were gradually introduced and repeated.

When an error was made in a sentence, *E* orally prompted *S*. After *S* completed the sentence, however, *E* required *S* to repeat the whole sentence. If the error was made again, the individual verbal stimulus concerned would be presented in the procedure involving a discrimination loop or the picture prompt, depending upon the verbal stimulus. This procedure would be repeatedly brought into the program until the proper textual discrimination was made. Repetition of various parts of the program occurred frequently whenever behavior was weakly controlled by a word or words.

Under the reinforcement condition, reinforcers were given for picture-matching responses, word-matching responses, appropriate echoic responses when *E* orally prompted *S* on a word, discriminations in the discrimina-

tion loops, as well as for textual responses. When a sentence was presented, reinforcement was not contingent upon individual word responses, but only on the complete sentence "response." Sentence responses were also reinforced when *S* texted a story.

### *Experimental Sessions*

Each *S* participated in eight 45-min sessions, divided into two 20-min periods separated by a 5-min break during which *S* could get a drink, rest, look out a window, or ride a rocking horse. The *Ss* also returned for a ninth session, but only for a test on some of the texts they had acquired.

At the end of each session, *Ss* were asked if they wished to return again. If the *S* showed signs of displeasure during a session, he was asked if he wanted to continue.

## RESULTS

At the beginning of the second session and at the beginning of every session thereafter, *S* was given a test consisting of an unaided identification of the new words with which he had been presented during the previous session, and the older words which he had as yet failed to text correctly during the previous test sessions. The response unit was a correct text, and these units were cumulatively plotted. The response measure was thus not of the "reading" responses made in the conditioning procedure, but of the texts formed as a result of this training.

The abscissa used in the cumulative curves is not a continuous time measure; each unit on the abscissa represents one training period. The cumulative curve, consequently, does not indicate a rate of response during the conditioning procedure itself. Rather, it indicates the number of textual responses formed per training period. In this sense the curves may be considered as analogous to a rate, the rate of acquisition of texts per training period.

The results of the study are of two types: those concerning the "cumulative curves" established on the basis of the acquisition of the texts, and the various other observations of *S's* behavior. These observations indicated that the experimental situation contained a number of response alternatives which can be discussed in two general categories: (1) behaviors which escaped the task, as for example, moving around the room, requesting

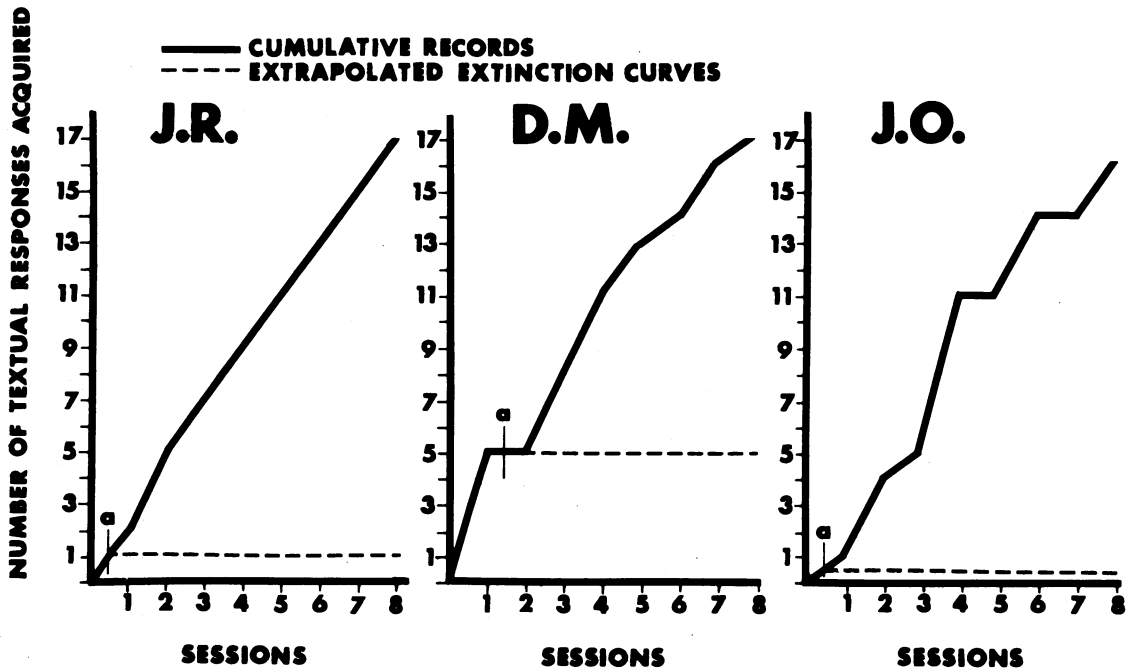


Fig. 1. The curves shown here were generated under a beginning period of no "extrinsic" reinforcement. When *S* would no longer remain in the experimental situation, reinforcement was instated as indicated by the mark on the curve. The dotted line commences at the point *S* would no longer remain in the experiment, and indicates the curve which would have resulted if reinforcement was not introduced.

to go home, and asking *E* irrelevant questions; and (2) the "reading behavior," as for example, looking at the visual verbal stimuli, looking at the pictorial prompts, and echoing *E*'s auditory prompts. The experimental manipulation of the reinforcers, contingent upon the "reading behavior," effected the relative strengths of these two types of behavior in all *Ss*.

Figure 1 presents the data for the No Reinforcement—Reinforcement *Ss*. Each record presents the data for a single *S* and is identified by *S*'s initials. As the curves indicate, without reinforcement the acquisition of texts does not commence, or it quickly ceases. That is, the program and the experimental situation without the added reinforcers seemed to have little reinforcing value, and they soon became aversive. Observation indicated that escape behaviors began to occur in the first session for all *Ss*, and two of them requested to leave within 20 min. The dotted line on the curve commences at this point and indicates what the curve would have been without reinforce-

ment. The other *S* emitted the same escape behavior in the first 15 min of the second session, as the dotted line shows. When the "extrinsic" reinforcers were introduced, however, the escape behavior largely disappeared; working behavior returned in good strength; and participation became enthusiastic. This was reflected in the textual acquisition curves. Under the influence of the reinforcers, the reading behavior in the situation was maintained in good strength for the eight sessions, although *DM* again began to evidence some escape behaviors toward the end of the program.

The *Ss* acquired totals of 16, 17, and 17 texts, tested out of context. Thus, the operant-conditioning procedures, in these few sessions, proved to be very successful compared with the reading achievement which these *Ss* would make in their *next* year's work in kindergarten. The length of time these young children worked at a task ("attention-span") was directly a function of the reinforcing properties of the situation.

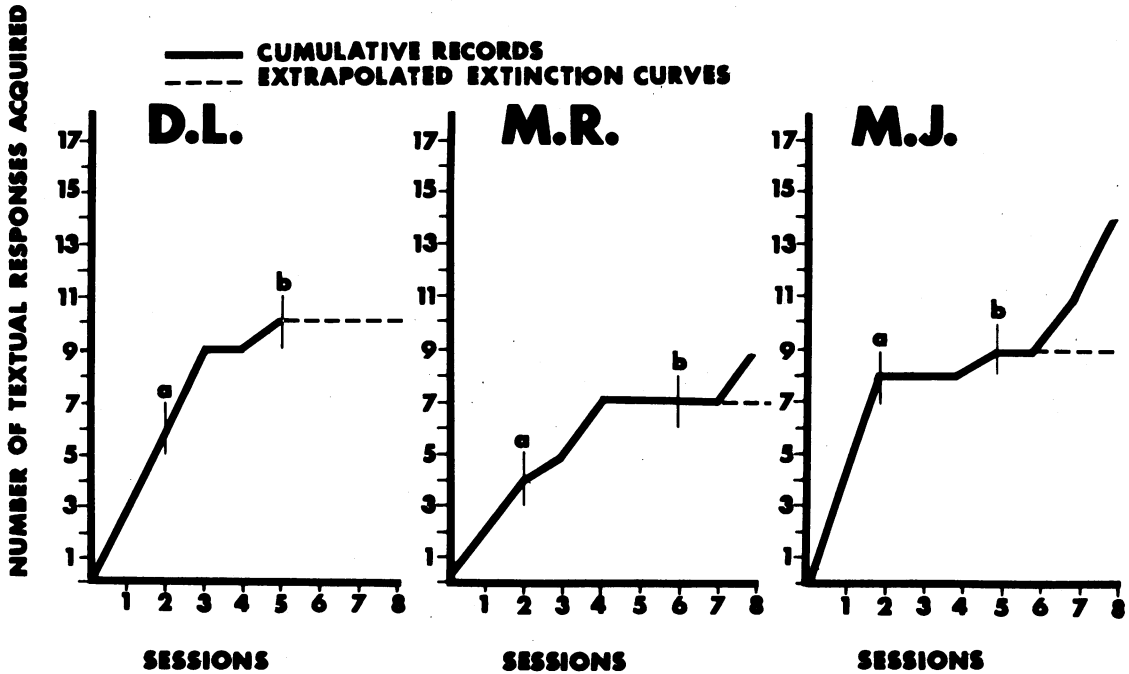


Fig. 2. For these Ss, the first condition included reinforcement which was discontinued at the point of the first mark on the curve. When S would no longer remain in the experimental situation, reinforcement was reinstated, as the second mark on the curve indicates. The dotted line commences at the point the S would no longer remain in the experiment and depicts the curve which would have resulted if reinforcement was not reinstated.

Figure 2 presents the data for the Reinforcement—No Reinforcement—Reinforcement Ss. In general, this experimental condition produced characteristic curves. The reading behavior, when reinforced, was quickly brought under experimental control with enthusiastic participation. When reinforcement was discontinued, both the reading behavior in the situation as well as the acquisition of texts soon began to weaken. Eventually, other incompatible behaviors (escape behaviors) became more frequent in the situation; and, finally, behaviors occurred which would have terminated the activity. Subject DL told his parents he did not wish to continue the activity, and E was told that DL's sixth session was to be the last. Reinforcement was reinstated at this time, and reading behavior in the situation was strengthened. However, DL had arranged to terminate and other evidence indicated that reneging would have been aversive; therefore, his curve of textual acquisition ceases at this point. Subject MR's mother called prior to the seventh session to say S

was terminating; but on E's statement that reinforcement would again be available, S returned to the experiment and reinforcement was effective in strengthening the reading behavior. (The dotted line on the curve indicates what would have occurred without reinstatement of reinforcement for this and the next S.) Subject MJ stated he would not read any more during the sixth session, but reinstatement of reinforcement was effective in strengthening the reading behavior.

Thus, in general, reinstatement of reinforcement strengthened the behavior of reading and staying in the situation (with one exception), and resulted in the return of textual acquisition. However, the effects of the No-Reinforcement treatment continued to operate for a time. The Ss' working behavior after the reinstatement did not attain its prior strength, nor was it as good as the behavior of the Ss in the other experimental condition after their short period of No-Reinforcement. Thus, a child with a history of no reinforcement for reading behavior (a "non-reader")

should be more difficult to train than a child who is just commencing his reading training.

The general results for all Ss indicated that the mixture of edible and trinket reinforcers plus the tokens backed up by the secret surprises appeared to work well, as Bijou and Sturges (1959) have shown; but there was some evidence that the reinforcers were weakening for some Ss in the later sessions. The tokens backed up by the secret surprise seemed to exert heavy control. This was evidenced especially in two cases where experimental control weakened markedly just after the secret surprise was obtained. This result suggests that something similar to a fixed-ratio schedule was operative because of the method of relating the tokens to the secret surprise. That is, the 24 tokens necessary to secure the reinforcer was analogous to a 1:24 fixed-ratio schedule. The same scalloping effect should result from the use of this token system, and the observations of reading behavior in the situation support this. Furthermore, since the tokens were in view of S, and obtaining the secret surprise removed all the tokens, this constituted an explicit S<sup>A</sup>.

### DISCUSSION

The study indicated that the original acquisition of texts is susceptible to laboratory study as a verbal operant under the control of visual verbal stimuli. The unit of behavior used with the sessions as a time variable produced curves analogous to cumulative records. Manipulation of reinforcement conditions produced characteristic changes in "rate." In addition, although different Ss had somewhat different rates, the records generated by the experimental procedure were generally consistent with respect to rate and the effects of the experimental variables.

The unit of behavior used indicates the actual textual responses which were acquired; and, in the absence of other information, it was selected as the best measure available. Results of the experiment, however, indicate that other units of behavior are involved in the experimental situation which would also produce interesting records. As manipulation of the conditions of reinforcement indicated, the "reading" behaviors underlying the acquisition of the texts can vary widely in strength (as do behaviors which are incom-

patible with the reading). In addition, the strength of these "good working" behaviors appeared to be sensitive to change in experimental variables and to be related to the rate of acquisition of texts; *e.g.*, in non-reinforcement, both units of response weakened.

Thus, on the basis of this study, it is suggested that the verbal operants (whether under echoic, pictorial, or textual control) could be used as a response measure in the present experimental situation. The time measure would then be a standard one, *i.e.*, units of time in the experimental situation. Continuous records could be kept of the time S is in the experimental situation, and cumulative records would be closely analogous to standard laboratory records. Further research will be concerned with developing this cumulative "reading response" measure and with its relationship to the one used in the present experiment.

The texting program worked well in conjunction with the additional reinforcers. In constructing the program, it was found that simply presenting a word stimulus to a child with an accompanying auditory prompt was ineffective in bringing the child's vocal response under the control of the word stimulus. With this method the child could echo the prompt and be reinforced without looking at the words. The system of using pictorial prompts, where appropriate, and word discriminations for the nonpictorial words, removed this difficulty. Ineffective behaviors such as guessing were not strengthened in this procedure. The program moved gradually, with many trials on each textual stimulus. It was found that single textual stimuli could rapidly be worked into sentences and small "stories."

However, the results indicated that the texting program with only social reinforcers was not reinforcing for very long. In fact, alone it quickly produced escape behaviors of many kinds, finally culminating in a request to leave the situation for good. The introduction of the additional reinforcers contingent on the reading behavior reversed this, at least for the periods included in the study. This was, perhaps, the primary value of the reinforcers; *i.e.*, they strengthened the behaviors of staying in the situation and working.

In view of the practical importance of improvements in the teaching of reading, and

the feasibility of the application of operant-conditioning procedures to this task, further research is planned to extend the present findings. This research will investigate (1) the extension of the procedure to a program for developing units, *e.g.*, letter and syllabic texts; (2) the development and exploration of a cumulative record based upon "reading" responses in the experimental situation, and the relationship of this record to curves based on the acquisition of textual responses as used in the present study; (3) the effects of intermittent-reinforcement schedules; (4) the effects of the "schedule" of pairing of tokens with the reinforcers; (5) the duration of the reinforcers; and (6) automation of the procedure.

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